Multiple Indicator Monitoring of Streamside Livestock Grazing

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Five factors that affect aquatic species

► streamflow

► water quality

► energy source

► physical <u>habitat</u> structure

► biotic interactions

Overview of livestock grazing effects

► Livestock grazing effects to fish habitat -

- Effects on vegetation adjacent to the stream (water quality, energy source, habitat structure)
- Effects on the streambank – trampling
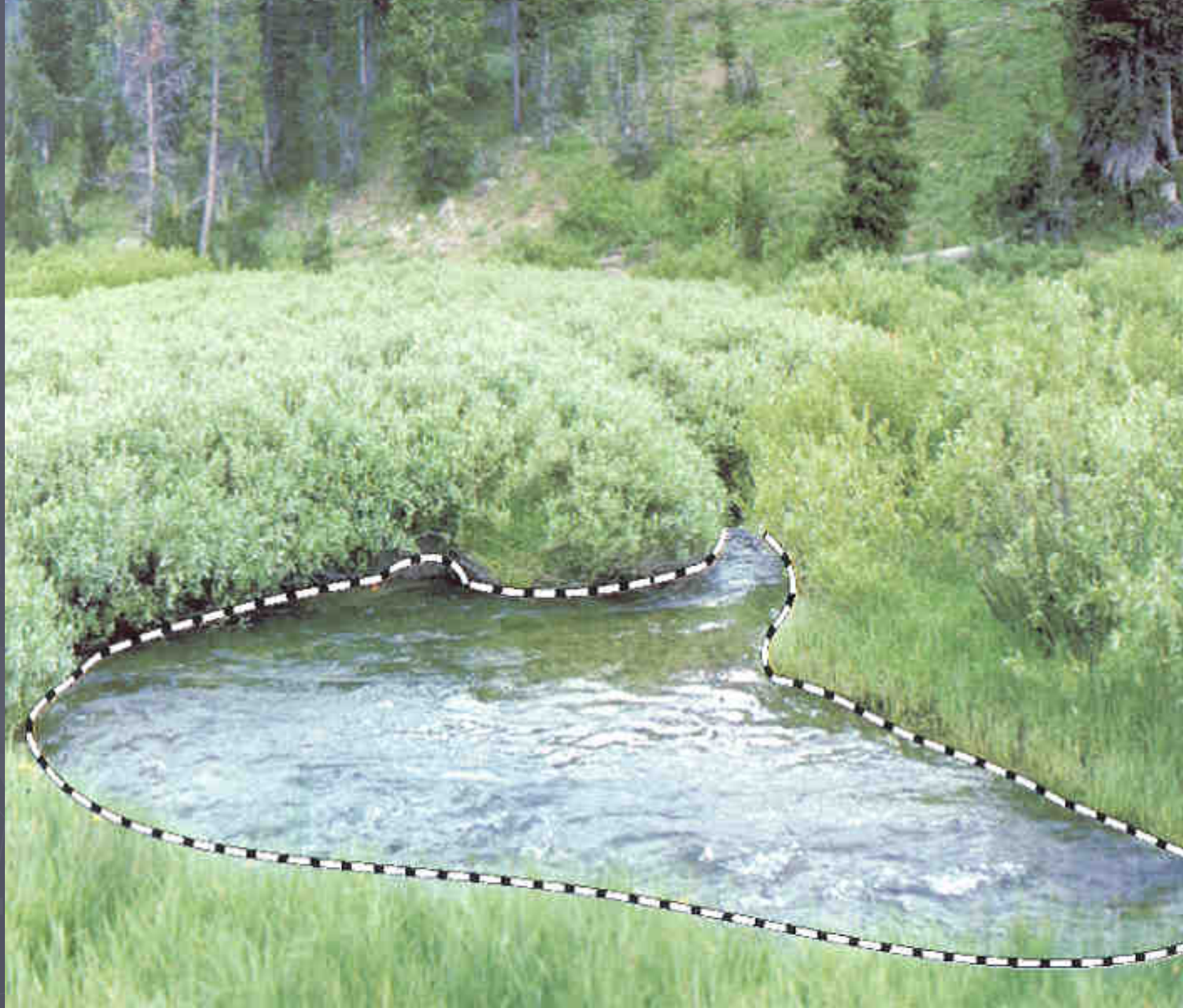- (water quality, habitat structure)

Surrogates for Livestock Grazing

► Cost – effective

► Timely – indicative of impacts when they occur

► Reasonable level of precision

Grazing Surrogates

► Streamside vegetation -
   Along the "Greenline"
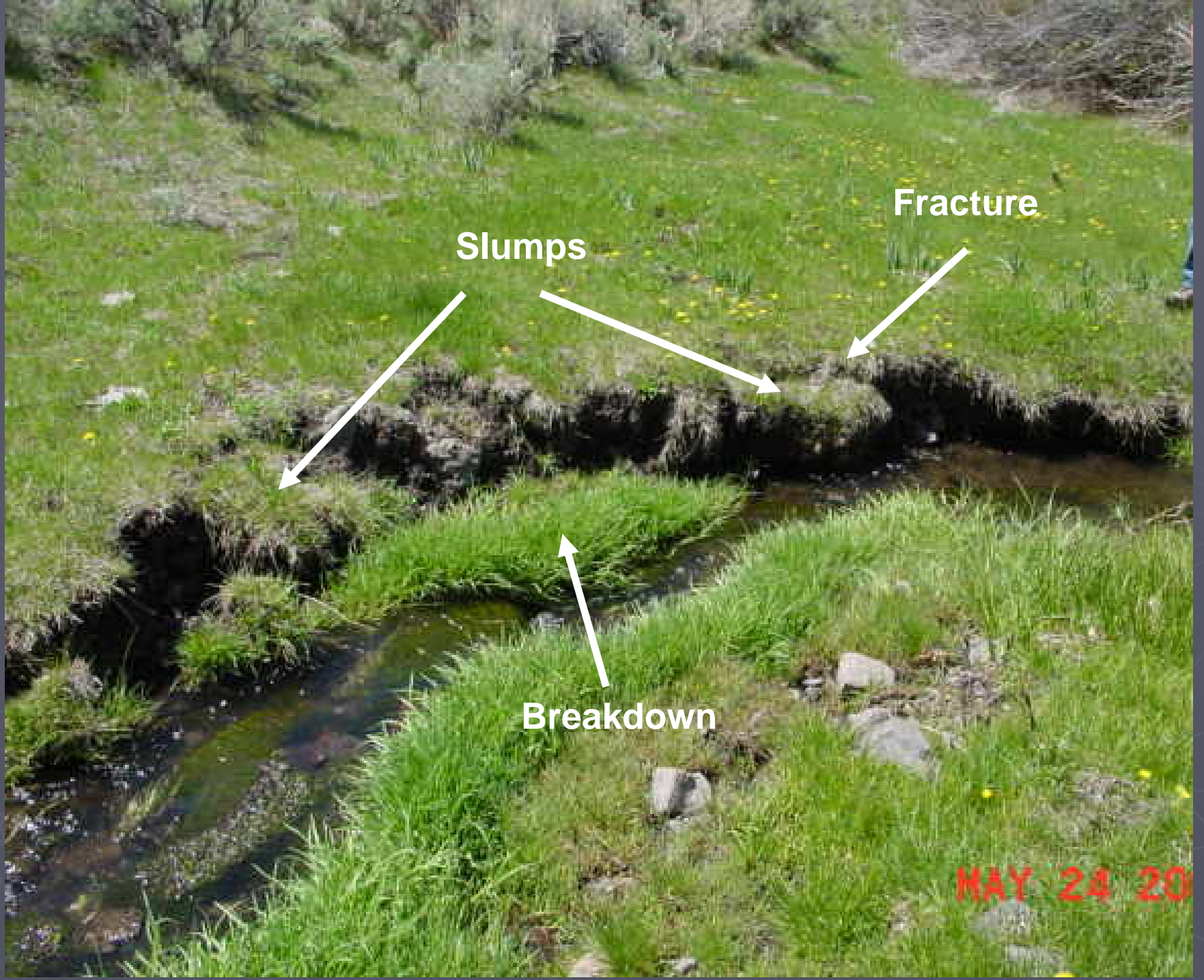

► Streambank stability -
   Along the stream margins

Pathways

Streamside vegetation
cover and rooting $\longrightarrow$ Overhanging vegetation,
undercut banks, shade,
submerged cover, etc.

$\longrightarrow$ Nutrient input $\longrightarrow$ Primary productivity

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Streambank stability $\longrightarrow$ Narrower/deeper

$\longrightarrow$ Increased bank
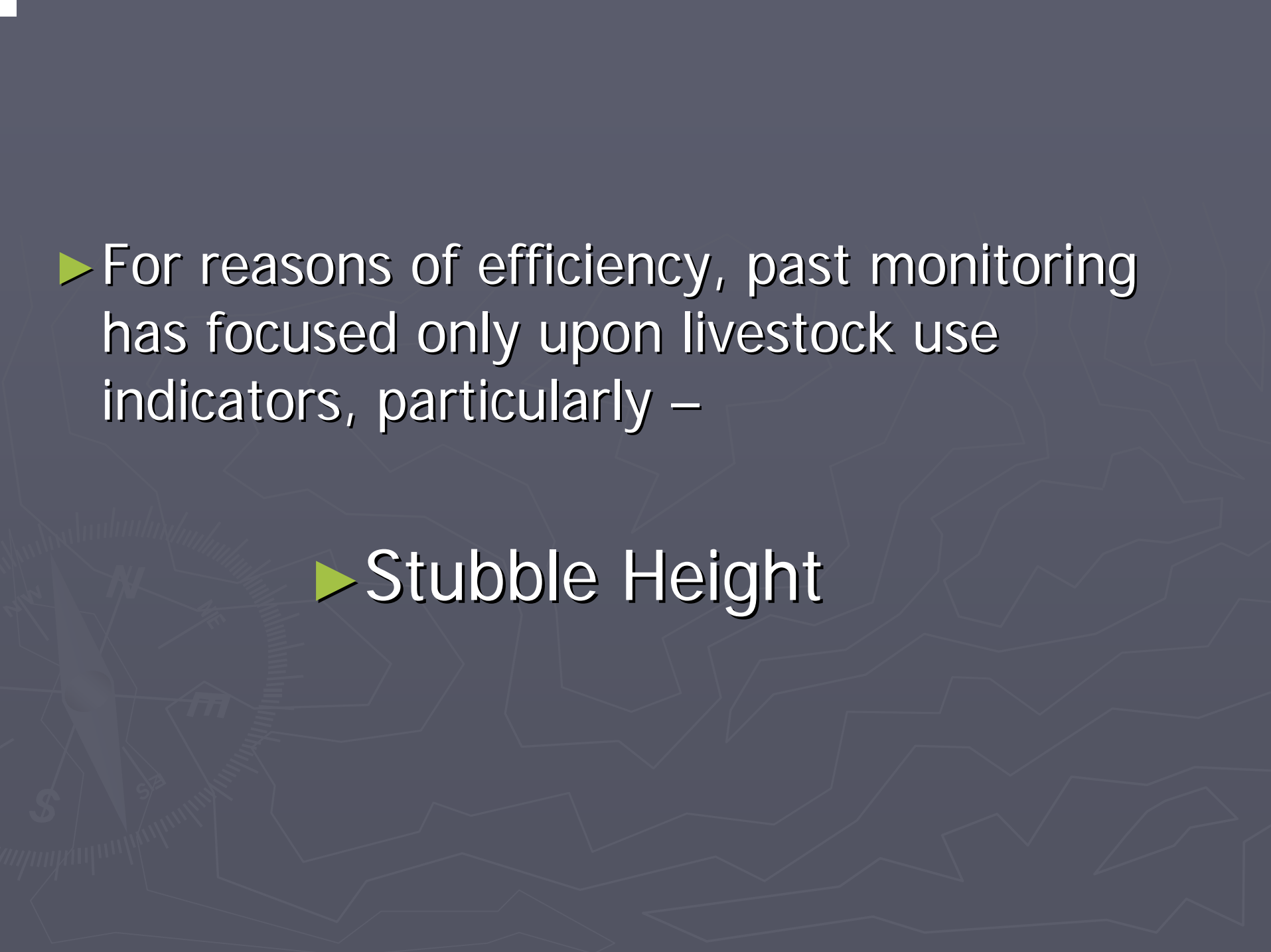storage $\longrightarrow$ Increased baseflows,
Narrowed temperature
Range, etc.

Indicators

- Streamside vegetation
  - Herbaceous vegetation
    - Stubble height – livestock use indicator
    - Greenline plant composition and health
  - Woody
    - Woody utilization – livestock use indicator
    - Greenline composition and regeneration

- Streambank stability
  - Streambank alteration – livestock use indicator

  - Streambank stability

► For reasons of efficiency, past monitoring has focused only upon livestock use indicators, particularly –

► Stubble Height

Why?

- ► Cost
  - ■ Time/cost to sample using multiple methods
  - ■ Protocol
    - ► Some methods require a lot of training (e.g. plant species ID)
    - ► Depending on the method, sampling occurs at different locations adjacent to the stream
    - ► Ease of sampling – stubble height is comparatively simple
    - ► Accuracy – stubble height is repeatable
    - ► Precision – requires relatively few samples

PROBLEM!

► Linkages between Stubble Height and Riparian function have not been adequately researched

► Useful only where herbaceous vegetation controls bank stability

► Is not always a good indicator of bank disturbance

► The standard must be based upon the growth potential of individual or groups of hydric species

What is Stubble Height ?

► Stubble height is **<u>NOT</u>** a riparian management objective, but an **<u>indicator</u>** of livestock use and potential impact.

► A measure of vegetation height remaining after grazing.

Stubble Height as a Criterion

▶ Based on limited research, the authors proposed a 10 cm residual stubble height as a "**starting point for improved riparian grazing management.**" However, they acknowledge that, in some instances, 7 cm may provide adequate riparian protection, and that in others 15 to 20 cm may be required to limit streambank trampling or to reduce willow browsing.

Stanley Creek Research Site

Not here

The criteria were based upon: Grazing use of hydrophilic vegetation along the margins of the stream.

Appropriate Use of Stubble Height

"In combination with longer term monitoring of vegetation and channel parameters"

(U of I Stubble Height Study Team 2004)-

i.e. multiple indicators

Usefuleness of Multiple Indicators

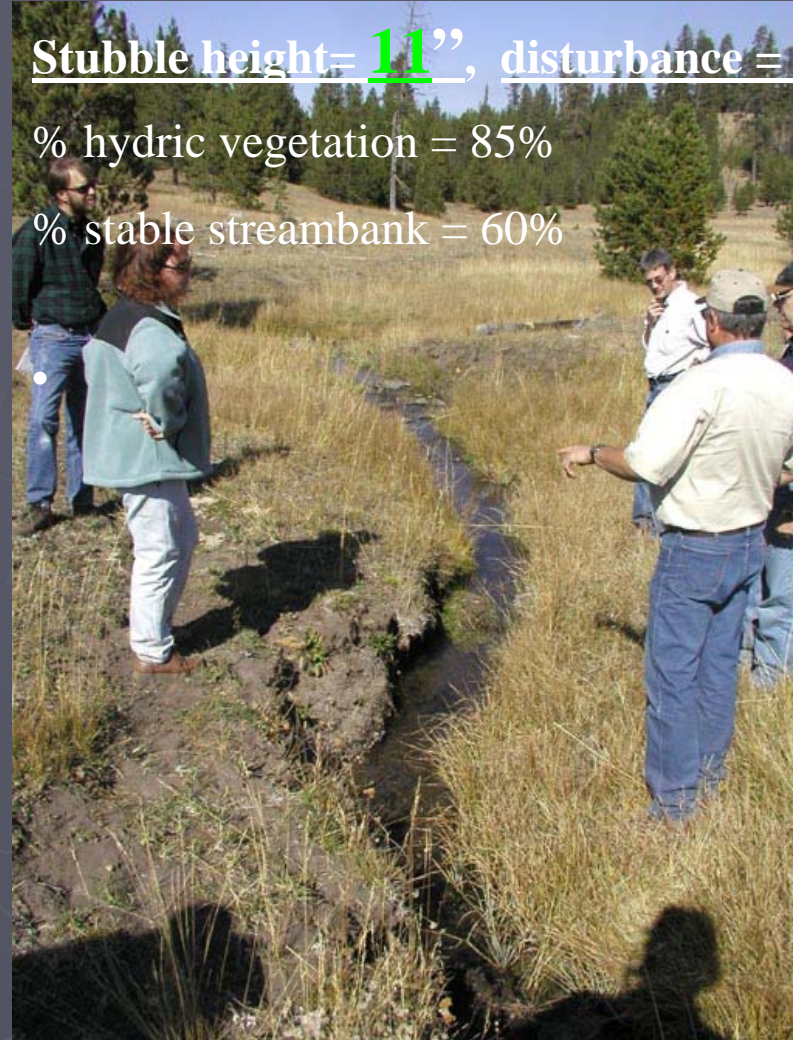**Stubble height= _4"_, disturbance = 23%**

•% hydric vegetation = 86

•% stable streambank = 68

Stubble height reflects condition
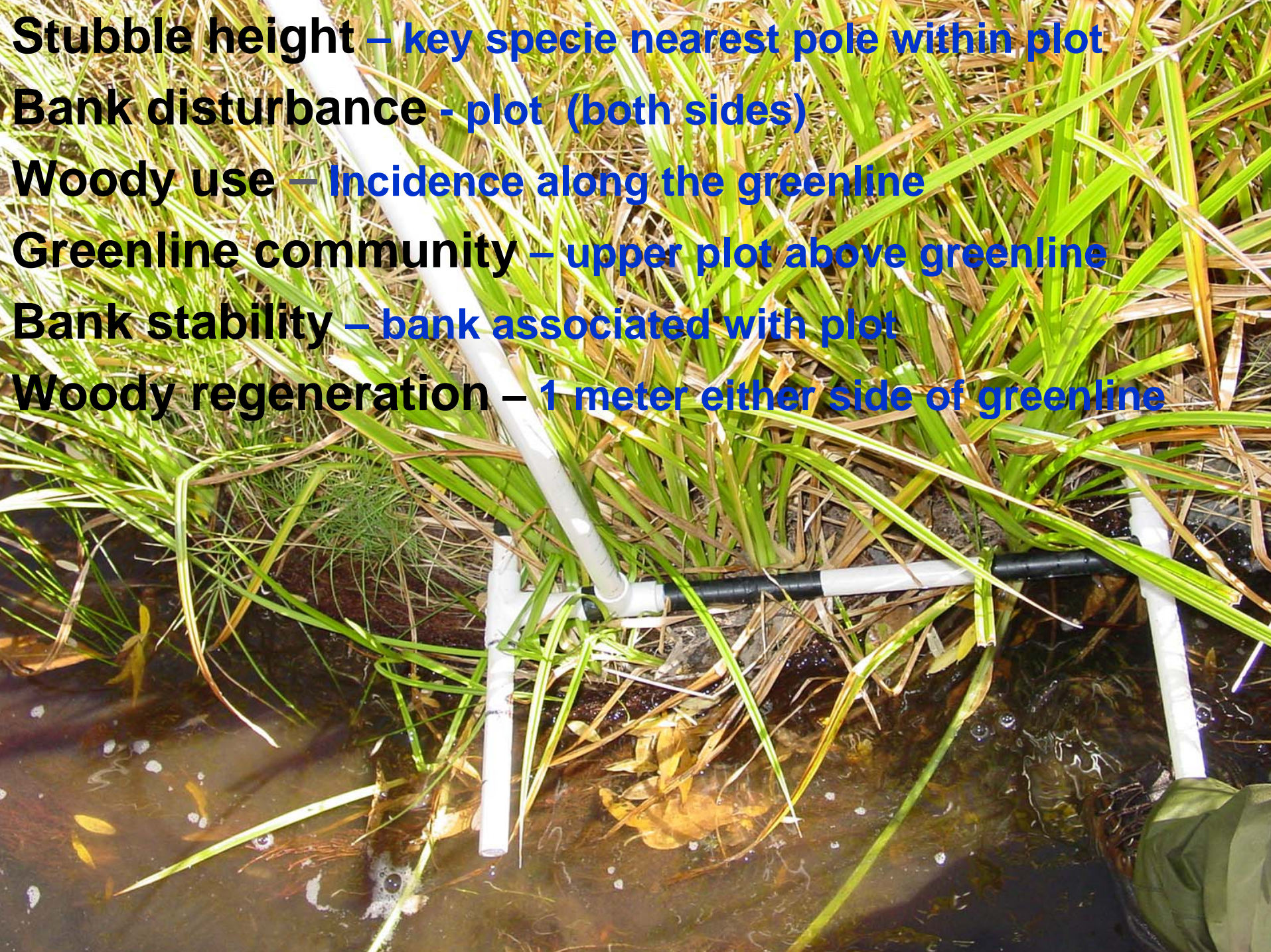

Stubble height= _11"_, disturbance = 30%

% hydric vegetation = 85%

% stable streambank = 60%

Stubble height does _not_ reflect condiition

Proposed approach: spaced quadrats along the greenline

Spaced quadrats

Greenline

Stubble height – key specie nearest pole within plot

Bank disturbance - plot (both sides)

Woody use – Incidence along the greenline

Greenline community – upper plot above greenline

Bank stability – bank associated with plot

Woody regeneration – 1 meter either side of greenline

Collecting multiple indicators- allows local stubble height criteria refinement.

Stub Height Line Fit Plot - Long Tom Creek
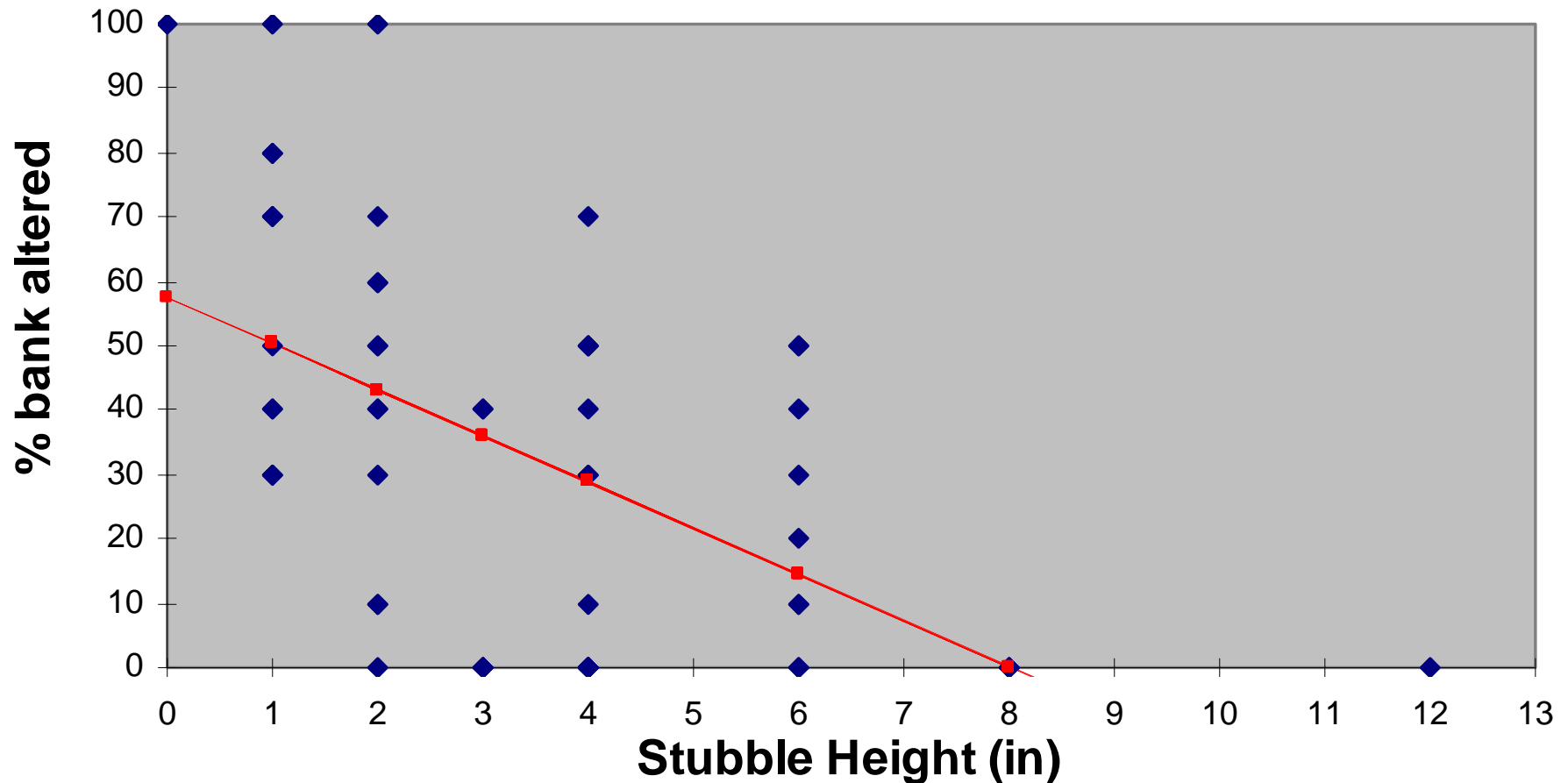
- **Where:** "<u>Designated monitoring areas</u>": areas along stream reaches that are used by livestock and other large herbivores.

- **Sample size:** The reach is 110 meters or about 361 feet of stream. 40 to 50 plots each side of stream

- **Method:** paced transect along the greenline (as defined by Winward 2000). The interval is determined by the number of plots needed to achieve desired confidence level.

Protocols are based on....

► Stubble Height – Interagency Tech Reference (1996)

► Woody browse – Interagency Tech Reference (1996)

► Bank Alteration – Cowley 2004

► Vegetation - Winward (2000) and Coles-Ritchie *et al* (2003)

► Bank Stability - Henderson *et al* (2003)

Tests – 5 teams

► Bank alteration –

- Mean – 21%, Range 16% to 27%

► Woody browse –

- Mean .14%, Range 0 to .7%

► Stubble Height –

- Average = 6.1, Range 5.7 to 6.4

Tests

► Dominant greenline vegetation

  ▪ Caaq on 43% of plots, Range 36% to 49%

► Sub-dominant greenline vegetation

  ▪ Mf on 57% of plots, Range 51% to 64%

► Woody regeneration – seedlings/saplings

  ▪ Mean 18%, Range 7% to 26%

► Woody regeneration – young plants

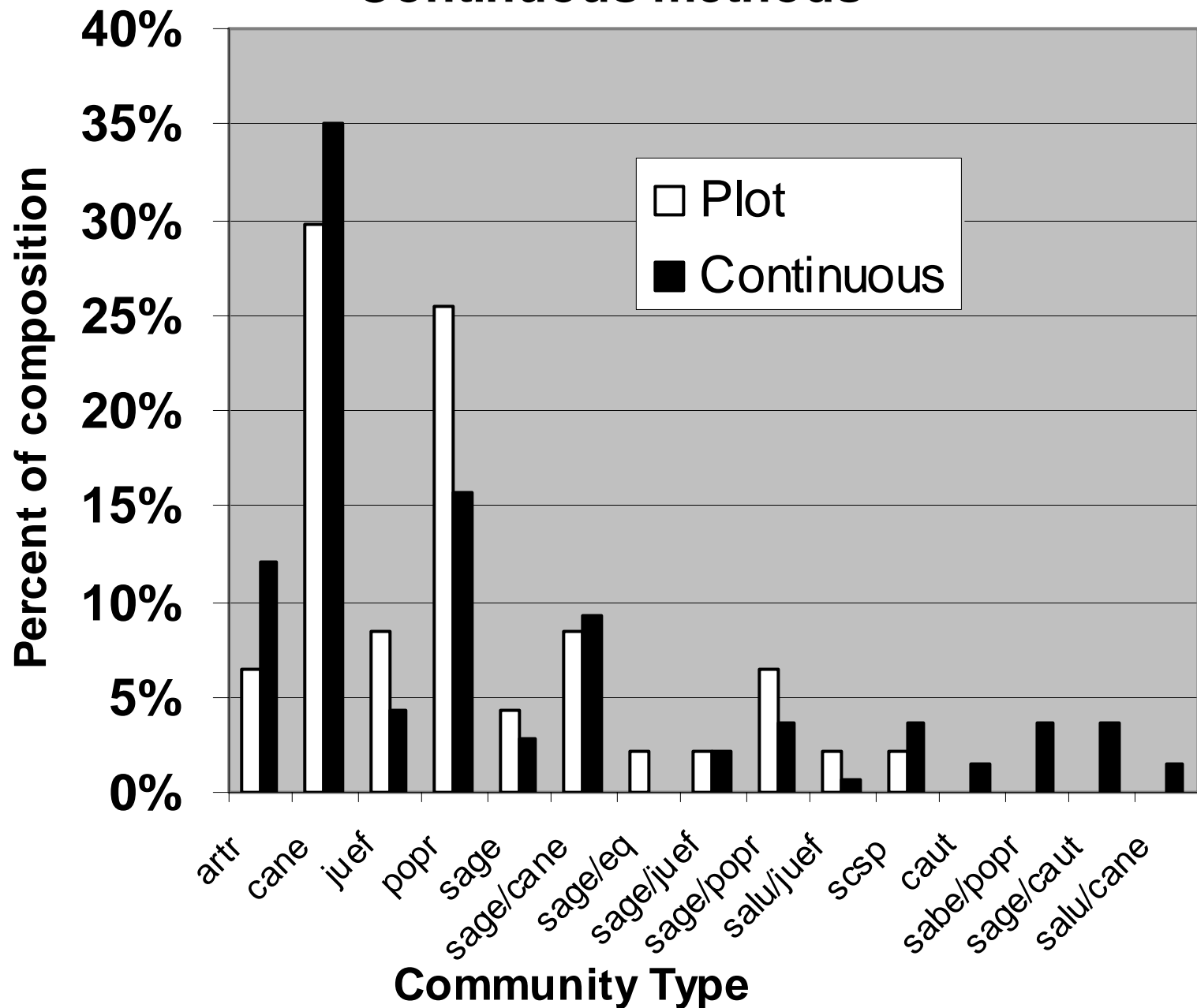 ▪ Mean 39%, Range 26% to 45%

Tests

► Streambank cover
  - Mean 93%, Range 91% to 95%

► Streambank Stability
  - Mean 84%, Range 78% to 90%

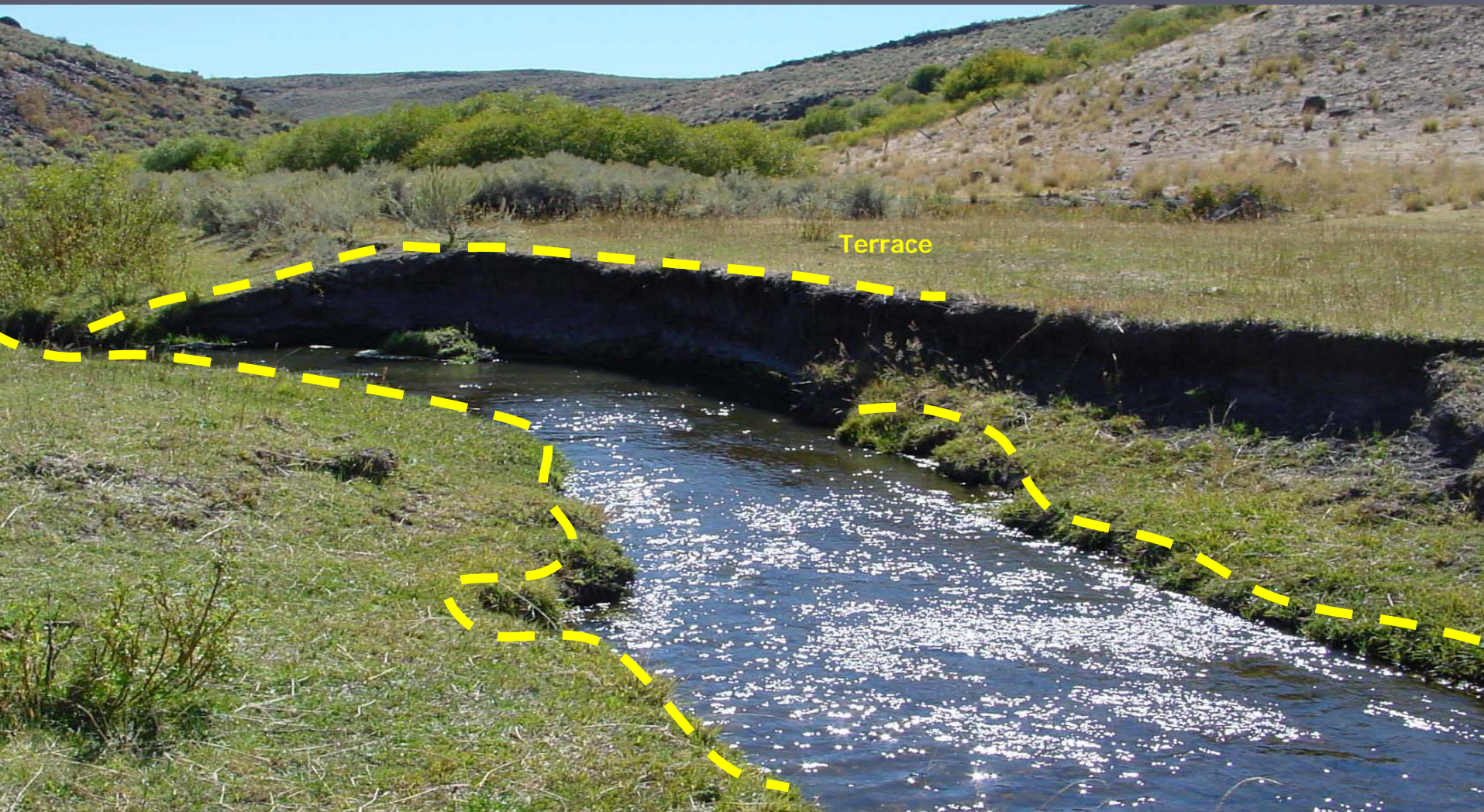Percent greenline composition - Plot vs Continuous methods

The "Greenline"

Terrace

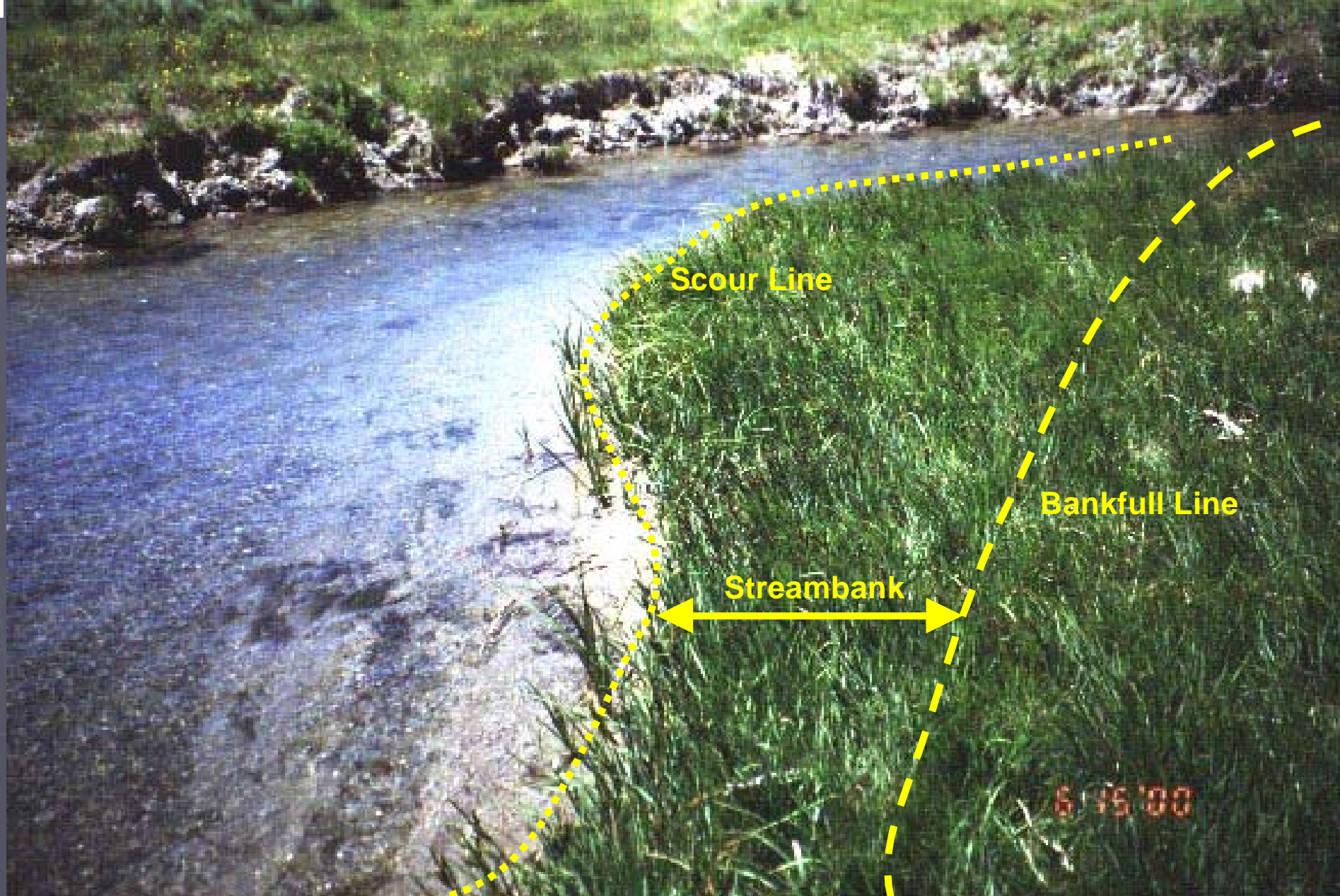The first perennial vegetation above the water line

The greenline is on the streambank approximately parallel to the water flow.
Streambanks perpendicular to the stream flow are not considered greenline.

Shearing

Bank Trampling

MAY 10 2001

Scour Line

Bankfull Line

Streambank

6 15 00

Conclusions

► Precision & Accuracy affected by ability to correctly locate the "greenline", sample size, and training

► Using a single indicator like stubble height is not appropriate.

► One size does NOT fit all.

► Multiple indicators at the same location or plot has advantages.